MIDDLE CREEK HYDROELECTRIC DAM
On Middle Creek, west of U.S. Route 15,
three miles south of Selinsgrove
Selinsgrove Vicinity
Snyder County
Pennsylvania

HAER No. PA-220

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
Northeast Region
U.S. Custom House
200 Chestnut Street
Philadelphia, PA 19106

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Location:	On Middle Creek, west of U.S. Route 15 three miles south of Selinsgrove. Selinsgrove vicinity. Snyder County, Pennsylvania UTM: 18.341890.4514360 Quadrangle: Sunbury, PA
Dates of Construction:	1906 and 1936.
Engineer:	F.W. Darlington, Philadelphia -- Chief Engineer; E.F. Shatzer, Middleburg -- Hydraulic Engineer.
Present Owner:	State of Pennsylvania Pennsylvania Fish Commission Harrisburg, PA
Present Use:	Abandoned hydroelectric facility; dam is to be breached October 1992; hydroelectric generating facility and dike to be left standing but with electric generating equipment removed.
Significance:	The Middle Creek Hydroelectric Dam is a significant example of a timber crib dam and small electric generating station, that is typical of early rural electrification in America. Locally it was a major component of a conscious plan to modernize and promote a rather depressed county in Pennsylvania. After a period of disuse, it was revived and remained an active hydroelectric site until 1991.
Project Information:	After being abandoned by the Pennsylvania Power and Light Company in 1954, the dam and associated facilities eventually came into the possession of the Pennsylvania Fish Commission (PFC). In 1982 the PFC leased the dam to American Hydro Power Co. (AHP), subject to regulation by the Federal Energy Regulatory Commission (FERC). In 1992 FERC declared the timber dam unsafe and ordered it breached. As the site was deemed eligible for the National

Register by both FERC and the Pennsylvania State Historic Preservation Office (SHPO), a Section 106 review was initiated, the result being a finding of adverse effect. To mitigate the adverse effect of the breaching the SHPO recommended that historical documentation (written, graphic, and photographic) be provided of the site. This documentation was undertaken to satisfy this requirement.

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Historical Background

The dam and associated hydroelectric facility were constructed in 1906 after several years of work in organizing an electric power company. The site selected was formerly known as the Hoover Water Power and had previously held a smaller timber dam that powered grist and saw mills for most of the nineteenth century. The Hoover family owned the land around the old dam from 1874 until 1905.

The Middlecreek Electric Company was organized in 1905, although its final form only emerged somewhat later through a merger of several smaller franchises from the surrounding towns of Middleburg, Selinsgrove, and Sunbury and the previously operating Northumberland Electric Light, Heat and Power Company which had a coal fired plant. The electric company was closely linked with the Sunbury and Selinsgrove Electric Railway Company and with the Sunbury Bridge Company, both also formed in 1905.

The prime mover of the hydropower initiative was George W. Wagenseller of Middleburg, Pennsylvania. Wagenseller owned and edited the Middleburg Post and was a major booster of Snyder County which lay across the Susquehanna River from the more densely populated and industrialized Northumberland County. Snyder County was then suffering a long decline in population and wealth due to its lack of natural resources (earlier logging and mining were played out) and its relative isolation.

Wagenseller saw electric power as the key to linking the two counties via a bridge and trolley over the river. Thus Northumberland County's greater markets for produce and jobs

would be open to Snyder County, whose land values and incomes would inevitably rise. The linkage of the three projects was demonstrated by the electric company purchasing a large block of the bridge company's stock, and by the towns of Selinsgrove and Hummel's Wharf demanding that trolley service be a prerequisite for approval of the electric company's rights-of-way. The completion of the dam and the bridge caused a brief boom in eastern Snyder County, a boom which was aided by some surreptitious land speculations by Wagenseller and others. Unfortunately the boom was short-lived, and Snyder County did not recover its prosperity until the 1920s.

While considering the erection of a dam, Wagenseller and others visited the Irondale Hydro-Electric plant in Bloomsburg, Pennsylvania and even initially hired its engineer. The first scheme for Middle Creek was to erect a tunnel through an adjoining hill to get more water from Penn Creek, but this proved too expensive and unnecessary as Middle Creek was found to have sufficient water. The chief engineer of the dam as constructed and its generating facility was F.W. Darlington of Philadelphia. A local hydraulic engineer, E.F. Shatzer, was also important in the early aborted schemes and in computing the volume of water power available.

After bids from general contractors proved too expensive once again, in April of 1906 the electric company decided to build the dam themselves. Subcontracts went to E. Morgan Smith Company of York, Pennsylvania ($4,825 for the turbines) and to the Westinghouse Electric & Manufacturing Company ($11,333 for the generators and other electrical equipment). Work began in April and by June the company was advertising for 25 masons and 150 other workers. The company erected boarding houses and sleeping quarters on the site for the workers. During construction, labor trouble occurred when a "gang of foreigners" arrived to work only to strike and leave the site the next day.

Despite this trouble the work proceeded quickly. By the end of August the transmission line was connected from Middle Creek to Northumberland; November 2, 1906 the last spike was driven in the dam; and on November 22nd the first power was generated. An official opening soon after drew over 1000 visitors. The facility transmitted power at 16,600 volts. The most immediate and dramatic local changes were arc lights on the streets of Selinsgrove and the trolley which began operating across the newly competed bridge in 1907.

As now, the complex consisted of the timber crib dam, a hydroelectric generating facility (turbine pit and powerhouse containing the generator), and an earthen dike which held back the corner of the lake beyond the turbine pit. The turbine in

place at the time of breaching is the original one, though the generator was replaced in 1983.

In 1911 the Middlecreek Electric Company (which never made a profit) was sold to the Northumberland County Gas and Electric Company for $235,000. In 1920 this company and others merged to form the Pennsylvania Power and Light Company. Such mergers were a major step towards today's unified power grid across the country. Repairs were made to the dam and power plant in 1914, and, according to photographs in the possession of Pennsylvania Power and Light Company, repairs were made to the turbines and switch gear in 1922.

In 1934 a storm and resulting flash flood destroyed the dam, which was under repair at the time. The flood also destroyed the covered Hoover's Bridge slightly downstream from the dam. The dam was replaced in 1936, the new one having a slightly different design. Parts of the base of the old dam were reused, and the turbine pit and powerhouse were mostly unchanged, although the generator was rebuilt.

Pennsylvania Power and Light abandoned the facility in 1954 and sold the dam, power plant, and upstream lake to Mark Musser (for whom the site is now often named). It eventually came into the possession of the Pennsylvania Fish Commission who made improvements at the site for recreational use. It was not used for making power again until 1983 when the American Hydro Power Company (who had obtained a lease from the Pennsylvania Fish Commission the year before) began operation. They rebuilt the turbine, installed a new generator and switch gear, replaced the hand operated head gate with an hydraulically lifted gate, altered the powerhouse, and installed a second turbine-generator in a penstock on the downstream side of the dam.

Description of the Dam Site

The Mussers Dam complex consists primarily of a timber crib dam, a hydroelectric generating facility (turbine pit and powerhouse), and an earthen dike. The dam runs east and west across Middle Creek and backs up a lake that stretches one-and-a-half miles upstream. At its western end is the turbine pit, to which is attached the powerhouse on the downstream side. The earthen dike stretches west from the turbine pit and holds back a corner of the lake. The main channel of Middle Creek lies below the timber dam. Below the powerhouse is the tailrace which is separated from the main channel by an island created when the dam was first built.

Several other buildings were originally part of the complex, but are not now part of the dam property and are not threatened. A brick house (very much altered and thus lacking much of its historic integrity) some distance from the powerhouse probably served as a transformer building. It appears in photographs with a flat roof. To judge from its style, it was probably built between 1936 and 1954 when power generation was abandoned. A small wooden shed (also near the powerhouse) also appears in old photographs as part of the powerhouse complex. It probably served a storage or other service function and has received a recent addition.

About 300 feet downstream from the powerhouse is a two-and-a-half story wood frame house that also once belonged to the dam complex. It was owned by the Pennsylvania Power and Light Company and occupied by the dam operator. It probably predated the hydroelectric dam, as its style seems to place it in the later nineteenth century. Its integrity is intact. Even further downstream are two churches that predate the dam and testify to the longstanding inhabitation of the site. A 1920s photograph shows a covered bridge downstream, but this was washed out in the storm of 1934 that damaged the dam. At present, the area around the powerhouse and these other buildings is heavily covered with trees and overgrowth. However, photographs from the 1920s reveal that this area was historically open, and that the house and churches downstream could be easily seen from the dam.

Dam

The timber dam is anchored at the east end by a concrete abutment dating from the original 1906 structure. The dam consists of a spillway section to the east 130 feet wide and 18 1/2 feet high and a non-overflow section next to the turbine pit 123 1/2 feet long and 21 3/4 feet wide. Both sections have an upstream slope of 1.7 horizontal: 1 vertical. The downstream slope is nearly vertical for the spillway section and 1 horizontal: 2.6 vertical for the non-overflow section. The horizontal crest width at the top is 21 inches. The spillway crest of the dam is at elevation 436 feet above sea level (the non-overflow section is 3'-4" higher), while the base of the dam is at elevation 417 feet.

The structure is a series of wooden bents made up of 8" by 8" timbers and set 3 feet - 7 inches on center. A horizontal chord lies embedded in the concrete base of the dam (this too survived from the original 1906 construction). Fourteen timbers of increasing height and tilted parallel with the steep downstream slope of the dam rest on the horizontal chord and support the top chord which forms the upstream slope of the dam. According to Jay M. Shaffer who helped build the dam in 1936, the timbers are butt jointed and connected with steel rods. The

joints cannot now be seen because all joints were reinforced with sister plates in 1983. Several 2" by 10" cross braces stabilize the timbers in each bent, and many 2" by 8" girts run horizontally from bent to bent. Jan Shaffer states that the dam was built from west to east and that the bents were assembled on the ground in place and lifted up, except for the last six which had to be assembled to the side and moved into place. He also remembered that the timbers were waterproofed with creosote, a job that was done in the winter because working with the hot, toxic substance in the summer would have been impossible.

In addition, the bents are held in a vertical position by the decking. On the downstream slope this consists of 3" by 8" boards with slight gaps between. On the upstream side 3 1/2 inch thick plank (on the lower half) and 2 1/2 inch (on the upper) form the actual water barrier. Jay Shaffer remembered that the planks were tongue-and-grooved and that the dam leaked profusely when first put into service in 1936/7, so much so that the lake would not fill and the builders had to use copious amounts of oakum to fill the cracks. Later still bituminous pitch was applied to most of the upstream slope to form a firm water barrier.

Along the spillway section of the dam are steel uprights installed in 1983 by American Hydro Power for flashboards which raised the height of the lake (and thus the head for power) a little over three feet. The flashboard assembly was designed to fail when the water overtopped them by two feet. The flashboards themselves were removed in 1991 by order of FERC.

At the west end of the dam, adjacent to the turbine pit/powerhouse, American Hydro Power also installed a small submersible turbine-generator in a steel penstock about 4 feet in diameter. The penstock extends through the dam to get water from the upstream side where it had an hydraulically operated slide gate and separate trash rack. The penstock is still in place, although the turbine-generator was removed at the same time as the flashboards. The turbine-generator discharged directly into the main channel of Middle Creek (as opposed to the tailrace under the powerhouse -- see below), and was used to maintain minimum stream flow. Near the penstock in the downstream face of the dam is a door for access into the dam itself.

In pre-1934 photographs, the original dam looks very much like the present one, except that it seems to have had a second short non-overflow section at the east end. Also, it had a timber fish ladder near the turbine pit.

Dike

The earthen dike was created to hold in the corner of the lake beyond the turbine pit created when the dam went into service in 1906. It was strengthened with rip-rap on its upstream side in 1936, and was further strengthened with sheet piling and extended eastward in 1983 when the flashboards on the dam raised the level of the lake which consequently leaked around the east end of the dike. It was also fitted with two piezometers which monitor water pressure inside the dike to spot leakage through it. The top and downstream side of the dike is covered with grass and other ground cover.

Hydroelectric Generating Facility

The hydroelectric generating station consists of two main pieces: the turbine pit and a powerhouse or generator room. The turbine pit is a squared rubble stone structure approximately 35 feet square and 24 feet deep (from the top of its parapet walls), with its floor 15'-8" below the top of the non-overflow section of the dam. Its east, west and north walls taper inward towards the bottom (so that the walls are thicker at the bottom where the pressure of water is greatest). Originally its walls were exposed stone, but in about 1938 they were parged with gunnite.

Water enters the pit through a wooden headgate on the upstream side, the segmentally arched opening for which encompasses nearly the entire south wall. A trash rack upstream of the gate prevents debris from entering. The present gate is hydraulically operated by two cylinders controlled by the automatic electric switchgear. In the case of power failure, a backup compressed nitrogen system automatically shuts the gates to stop power production and thus prevent damage to the turbine and generator. The present gate and operating system were installed in 1983 and replaced a gate operated by a hand-powered cast iron gear mechanism. Scars of the mountings for this earlier gate can still be seen on the south wall where a stone coping was terminated at each end for the gate's support beam.

The hydro-dynamics of the pit are fairly simple: water filled the pit and could only escape through the turbine unit which was mounted on the pit floor. The water exited the pit downward and flowed into the tailrace which ran under the pit and powerhouse. The tailrace is very deep (up to 12 feet) in order to allow the free passage of water and thus keep up the effective head pressure of the water on the turbines. The elevation of the top of the tailwater was 419 feet, just above the base of the dam.

The single turbine unit is horizontally mounted and has two turbines (one at each end) turning a single shaft which runs into the powerhouse through a slot in the pit's north wall. (A second

slot of the same size and east of the one for the shaft has never been used but may have been made for a possible second turbine unit.) Outside of and parallel to the turbine casing is a shaft and gear mechanism (connected through a small slot in the wall to a governor in the powerhouse) that regulated how open the turbine blades were. The size of the blade opening determined how much water flowed through the turbines, thus how fast they turned, and thus how fast the generator in the powerhouse turned. In engineering parlance this whole turbine assembly is called a single double humpback casing and runner. The turbine assembly was original to the dam and was rebuilt in 1983.

Before 1983 the top of the pit was ringed with wooden guard rails, and a wooden catwalk crossed the pit on its south side. Another catwalk still gives access to the gate lift mechanism. Stairs (now steel but formerly wooden) descend from the pit rim to the top of the dam.

In 1983 American Hydro Power installed a Toshiba prefabricated switchgear unit atop the south rim of the pit. Concrete walls were built above the original rim to support the unit which had a steel framework supporting its floor. The whole unit was hoisted into place by a crane. The switchgear mechanism contains all the controls, transformers, and circuit breakers for the generating facility.

The east wall of the turbine pit continues northward to form the wall of the powerhouse which adjoins the pit. The north and west walls of the powerhouse are wood framed from grade up, but concrete from grade down to the floor which spans the tailrace. The floor is now concrete supported on concrete beams running east and west and set approximately 8 feet on center. Before 1983 the floor was heavy timber planks resting on steel beams.

The wall's framing is original, but the original clapboard exterior covering was replaced in 1983 with plywood siding. Also in 1983 the walls were ringed inside with concrete parapets four feet high designed to act as a flood barrier and so protect the new generator. The original chamfered exposed purlin ends can still be seen along the eave line. In 1983 the window openings were also changed. Formerly the north (downstream) wall had three six-over-six double hung windows; now there are only two smaller one-over-one windows, though the size and position of the originals can be seen inside. Similarly, the west wall originally had the two extant doorways but also a now blocked six-over-six double hung window in the center. The pair of doors to the left was replaced in 1983, but the glazed and paneled entry door to the right is original.

Inside, the stairs leading from the entry door retain their original chamfered railing posts, and the roof trusses are also original. A former monitor opening in the roof is still visible inside, though the monitor itself was removed in 1983; the opening is still used to raise and lower equipment with a crane. The monitor had four-light windows at each end, but its primary function seems to have been as an attachment point for wires running inside.

At present the powerhouse holds a modern generator and governor which are connected to the turbine by shafts through the wall shared by the pit and powerhouse. The original generator was built by Westinghouse and it and its governor appear in photographs from the 1920s and after. It was installed in 1906 and rebuilt before 1936 (according to Jay Shaffer). The mounting pads for the original generator and governor are still in place. Prior to the installation of the Toshiba switch gear, the powerhouse also held the circuit breakers and switch controls for the complex. These appear in photographs from the period 1920 - 1950, and remnants of the wooden framework that held them can still be seen on the east wall. Photographs also show a variety of poles and transformers in the yard around the powerhouse.

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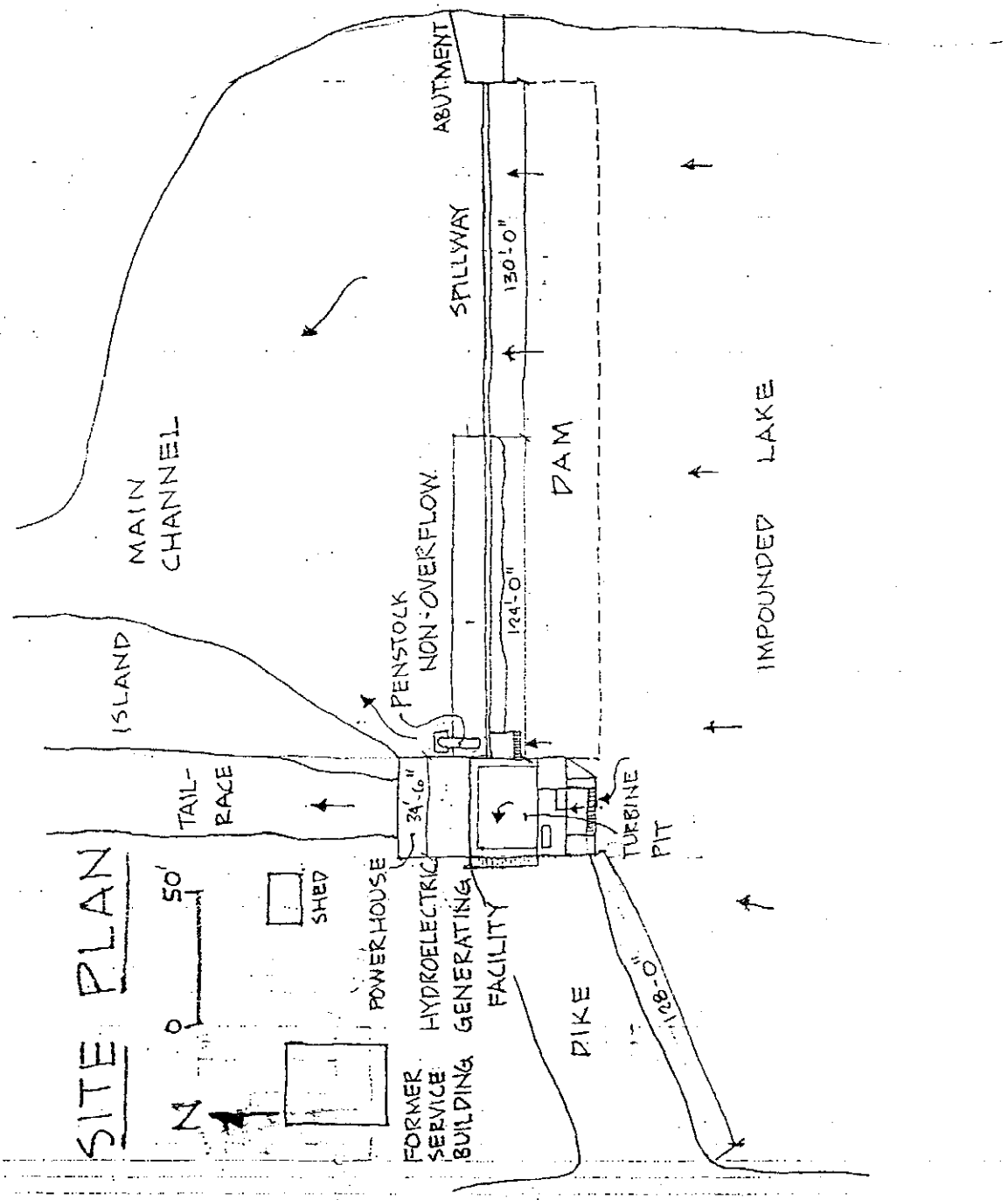
SITE PLAN
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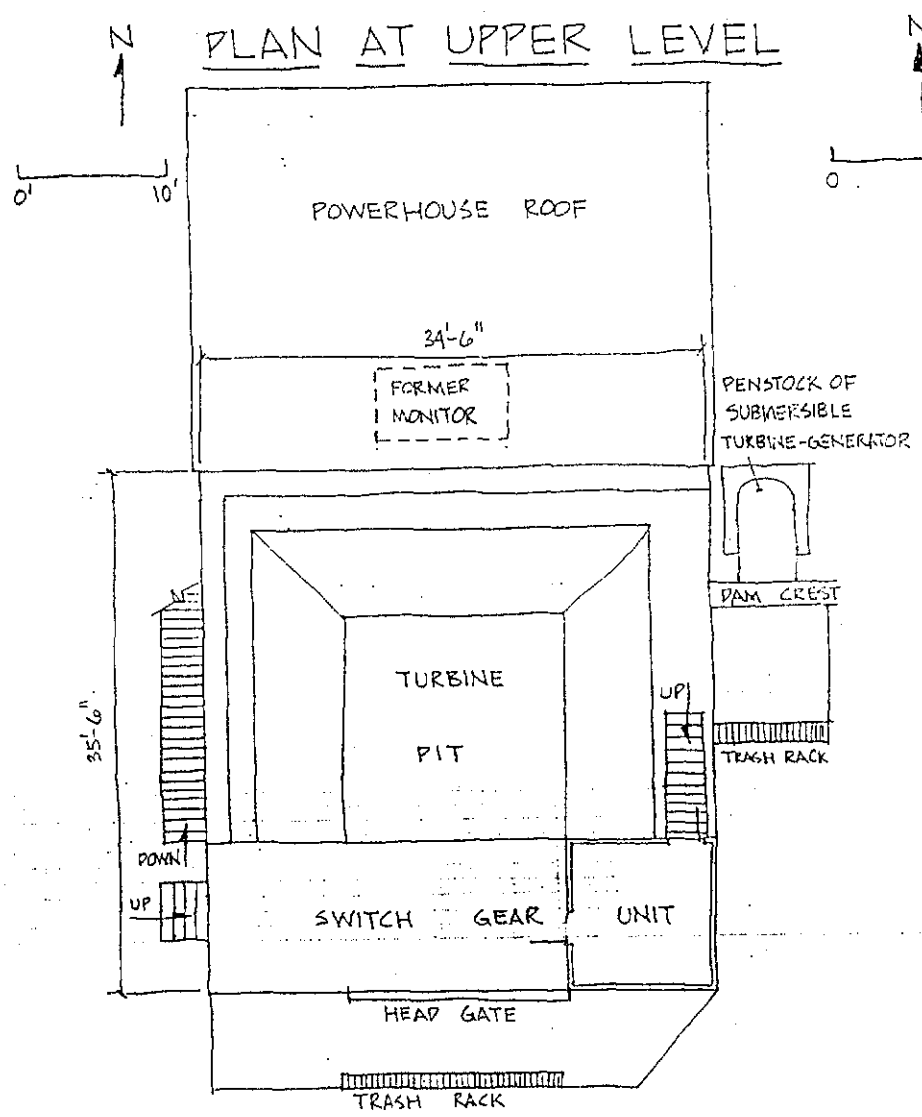
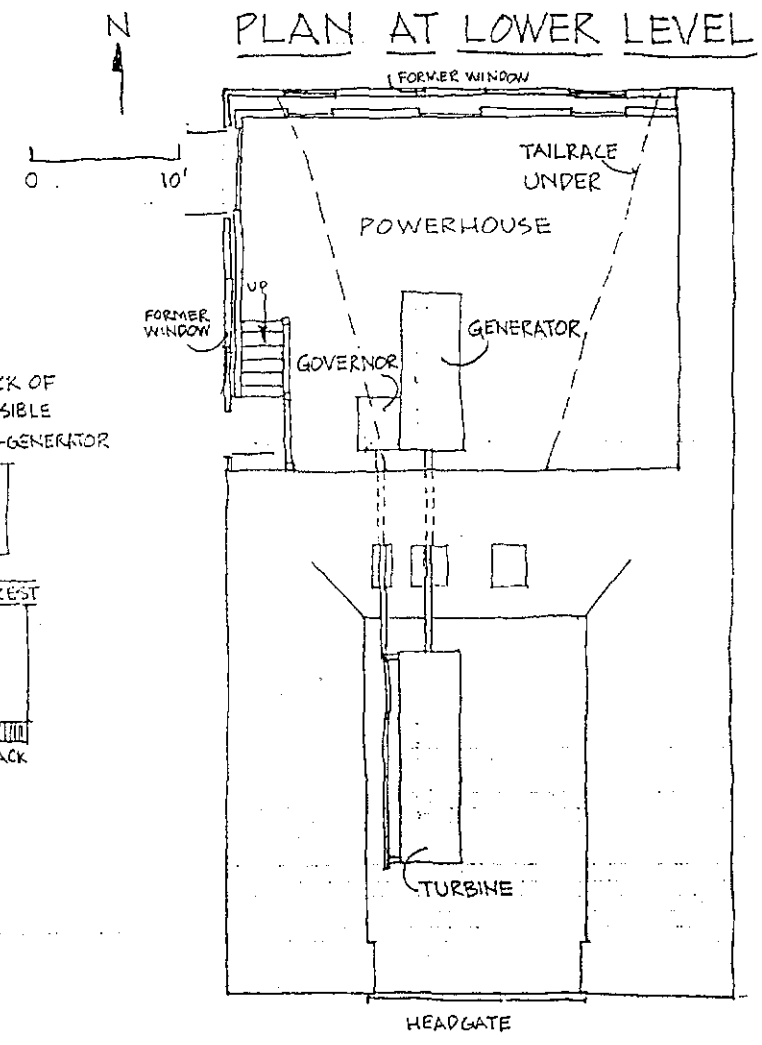
FORMER SERVICE BUILDING
POWERHOUSE
SHED
HYDROELECTRIC GENERATING FACILITY
TAIL-RACE
ISLAND
MAIN CHANNEL
PENSTOCK
NON-OVERFLOW
34'-6"
124'-0"
DAM
SPILLWAY
130'-0"
ABUTMENT
IMPOUNDED LAKE
TURBINE PIT
DIKE
108'-0"





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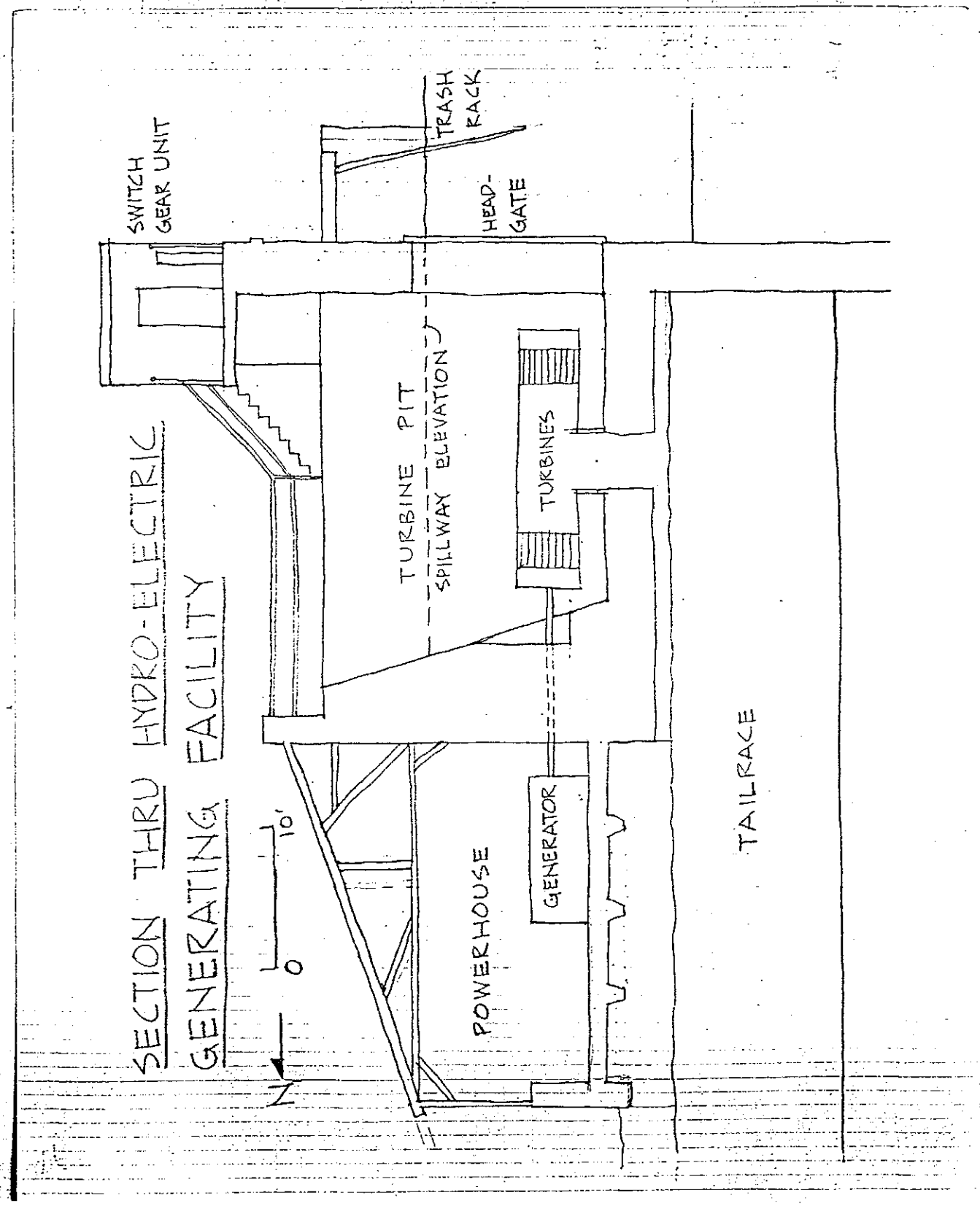
SECTION THRU HYDRO-ELECTRIC GENERATING FACILITY
SWITCH GEAR UNIT
TRASH RACK
HEAD-GATE
TURBINE PIT
SPILLWAY ELEVATION
TURBINES
GENERATOR
POWERHOUSE
TAILRACE
10'
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